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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/013,088	12/07/2001	Xiaoju Wu	TI-33227 (032350.B373)	1425

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EXAMINER

MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 04/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/013,088

Applicant(s)

WU, XIAOJU

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) 1-9 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group II, claims 10-18 in Paper No. 4 is acknowledged.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18, line 1-4, recites: wherein a relationship between a doping concentration of the semiconductor device and a lateral distance from the drift region is generally linear.

The limitation is not understood. Since there are so many regions (14, 16, 18, 26, 28, 30 e.g.) of the semiconductor device having doping concentration, therefore, it is not known which one of the doping concentration is being compared to a lateral distance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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3. Claims 10 and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon et al. (U.S. Patent No. 5,406,110) in view of R. Zhu et al., *Implementation of High-Side, High-Voltage RESURF LDMOS in a Sub-half Micron Smart Power Technology*.

With respect to claim 10, Kwon teaches a semiconductor device substantially similar as claimed including:

- a body region (28) of a semiconductor substrate (12);

- a drift region (14) adjacent at least a portion of the body region (28), the drift region comprising a dopant;

- a field oxide structure (26) adjacent a portion of the drift region (14) and a portion of a drain region (36), wherein the field oxide structure (26) is located between a gate electrode region and the drain region (36);

- an intermediate-dopant region (24) adjacent a portion of the field oxide structure (26), the intermediate-dopant region (24) comprising dopant atoms accumulated proximate the field oxide structure (26);

- a gate oxide (30) adjacent a portion of the body region (28); and

- a gate electrode (32) adjacent a portion of the gate oxide (30).

Thus, Kwon is shown to teach all the features of the claim with the exception of explicitly showing that the field oxide structure (26) is spaced apart from the gate electrode region.

However, Zhu teaches field oxide structure (OXIDE) is located between a gate electrode region and the drain region (DRAIN) and is spaced apart from the gate electrode (GATE) region.

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(See Fig. 1). Further, Kwon also teaches that a thin gate insulator (30) is grown over the entire surface of the transistor (10) and having a thickness of 200 to 500 Å, followed by forming the gate electrode (32).

Therefore it would have been obvious to one having ordinary skill in the art at the time of invention to show the field oxide (26) of Kwon is spaced apart from the gate electrode region by an oxide layer (30) as taught by Zhu since the formation of the gate electrode (32) is taken place after forming the gate electrode material over the oxide gate insulator (30), thus, the field oxide (26) always spaced apart from the gate electrode region. These are well known process steps.

With respect to claim 12, the intermediate-doped region (24) has a higher doping concentration (n) than a doping concentration (n-) of the drift region (14).

With respect to claim 13, the semiconductor device of Kwon further comprising a drain implant at the drain region (36), the drain implant having a higher doping concentration (n+) than a doping concentration (n) of the intermediate-doped region (24).

With respect to claim 14, the semiconductor device of Kwon further comprising a buried layer (p-) of the semiconductor substrate (12), wherein the buried layer is adjacent a portion of the body region (28).

With respect to claim 15, the semiconductor device of Kwon further comprising a LOCOS isolation structure (27) adjacent a portion of the drain region (36).

4. Claims 11, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon '110 and Zhu et al. as applied to claim 10 above, and further in view of Hsing (U.S. Patent No. 6,252,278) of record.

With respect to claim 11, Kwon teaches that the drift region (14) comprising a dopant of N-type.

Thus, Kwon is shown to teach all the features of the claim with the exception of explicitly disclosing dopant comprises phosphorous.

However, Hsing teaches that it is well known in the art to form N-type dopant regions such as 51 and 55 using phosphorous ions.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the drift region (14) of Kwon using dopant comprises phosphorous ions as taught by Hsing to form the N-type dopant region because phosphorous ions are lighter than other ions of the same dopant type, thus, less energy are required to place the dopant at a proper depth, hence more cost effective. This is well known in the art.

With respect to claim 16, in view of Hsing, the semiconductor device further comprising a spacer structure (59a) adjacent a portion of the gate electrode to protecting the side surface of the gate.

With respect to claim 17, in view of Hsing, the semiconductor device further comprising a drain contact (38) at the drain region (54), the drain contact (38) operable to facilitate a flow of electrode current through the semiconductor device.

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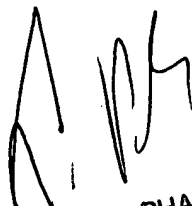
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
April 24, 2003


LONG PHAM
PRIMARY EXAMINER